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ABSTRACT

Focusing on finishing construction occupations, this document is one in a series of forty-one reprints from the Occupational Outlook Handbook providing current information and employment projections for individual occupations and industries through 1985. The specific occupations covered in this document include air conditioning/refrigeration/heating repairmen, drywall installers and finishers, electricians (construction), floor covering installers, glaziers, insulation workers, lathers, painters and paperhangers, plasterers, sheet metal workers, and tilesetters. The following information is presented for each occupation or occupational area: a code number referenced to the Dictionary of Occupational Titles; a description of the nature of the work; places of employment; training, other qualifications, and advancement; employment outlook; earnings and working conditions; and sources of additional information. In addition to the forty-one reprints covering individual occupations or occupational areas (CE 017 757-797), a companion document (CE 017 756) presents employment projections for the total labor market and discusses the relationship between job prospects and education. (BM)

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Construction Occupations — Finishing

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CE

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Bulletin 1955-15

Containing the midpoints of the legs of right triangle *RST*, where pt. (−5, 5), *S* is pt. (1, 1), and *T* is pt. (3, 4).

Containing the longer diagonal of a quadrilateral whose vertice pts. (2, 2), (−2, −2), (1, −1), and (6, 1).

Now that the equations $y - 1 = \frac{1}{2}(x + 3)$ and $y - 4 = \frac{1}{2}(x$ are equivalent.

An equation of the line containing pts. (−2, 3) and (4, −1) ca written in the form $y - 3 = -\frac{1}{2}(x + 2)$ or in the $y + 1 = -\frac{1}{2}(x - 4)$, depending upon which point you take a (x_1, y_1). Show that the two equations are equivalent.

Show that the equations are equivalent.

$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1) \qquad y - y_1 = \frac{y_1 - y_2}{x_1 - x_2}(x - x_1$$

State the equation of a line through pt. (p, q) and parallel to containing pts. (a, b) and $(c, 0)$, $(a \neq c)$.

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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CE 011 769

AIR-CONDITIONING, REFRIGERATION, AND HEATING MECHANICS

(D.C.T. 637.281 and .381, 862.281 and .381, and 869.281)

Nature of the Work

Heating and air-conditioning equipment makes buildings comfortable for work, study, or play. Refrigeration equipment makes it possible to safely store food, drugs, and other items. The types of equipment that provide these conveniences are complex. Air-conditioning, refrigeration, and heating mechanics are the skilled workers who install, maintain, and repair them. These workers usually specialize in one area but often have the ability to work in several

Air-conditioning and refrigeration mechanics (D.O.T. 637.281 and .381) install and repair equipment ranging in size from small window units to large central air-conditioning or refrigeration systems. When installing new equipment, they put the motors, compressors, evaporators, and other components in place, following blueprints and design specifications. They connect duct work, refrigerant lines, and other piping and then connect the equipment to an electrical power source. After completing the installation, they charge the system with refrigerant and check it for proper operation.

When air-conditioning and refrigeration equipment breaks down, mechanics diagnose the cause and make repairs. When looking for defects they inspect components such as relays and thermostats.

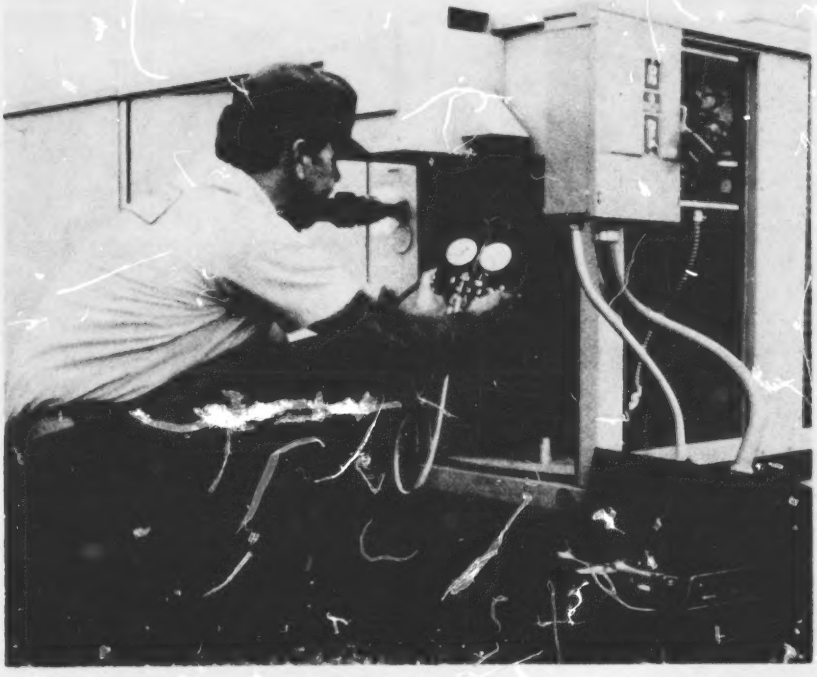
Furnace installers (D.O.T. 862.381 and 869.281), also called heating equipment installers, follow blueprints or other specifications to install oil, gas, and electric heating units. After setting the heating unit in place, they install fuel supply lines, air ducts, pumps, and other components. They then connect electrical wiring and controls, and check the unit for proper operation.

Oil burner mechanics (D.O.T. 862.281) keep oil-fueled heating systems in good operating condition. During the fall and winter, when the system is needed most, they service and adjust oil burners. If a burner is not operating properly, mechanics check the thermostat, burner nozzles, controls, and other parts to locate the problem. Mechanics carry replacement parts in their trucks to make repairs in the customer's home or place of business. However, if major repairs are necessary, they usually complete the repairs in the shop. During the summer when most systems are off, mechanics service heating units, replace oil and air filters, and vacuum-clean vents, ducts, and other parts of the heating system that accumulate soot and ash.

Gas burner mechanics (D.O.T. 637.281), also called gas appliance servicers, have duties similar to those of oil burner mechanics. They diagnose malfunctions in gas-fueled heating systems and make necessary repairs and adjustments. They also repair cooking stoves, clothes dryers, and hot water heaters. During the summer, mechanics employed by gas utility companies may inspect and repair gas meters.

Air-conditioning, refrigeration, and heating mechanics use a variety of tools, including hammers, wrenches, metal snips, electric drills, pipe cutters and benders, and acetylene torches. They also use voltmeters, electronic circuit testers, and other testing devices.

Cooling and heating systems sometimes are installed or repaired by other craft workers. For example, on a large air-conditioning installation job, especially where workers are covered by union contracts, duct work might be done by sheet-metal workers; electrical work by electricians; and installation of piping, condensers, and other components by pipefitters. Appliance servicers often install and repair window air-conditioners. Additional information about these occupations appears elsewhere in the *Handbook*.



Air-conditioning mechanic uses voltmeter to locate equipment breakdown.

Places of Employment

Approximately 175,000 persons worked as air-conditioning, refrigeration, and heating mechanics in 1976. Cooling and heating dealers and contractors employed most air-conditioning and refrigeration mechanics and furnace installers. Fuel oil dealers employed most oil burner

mechanics, and gas utility companies, most gas burner mechanics. Approximately 1 out of 7 mechanics was self-employed.

Air-conditioning and refrigeration mechanics and furnace installers work in all parts of the country. Generally, the geographic distribution of these workers is similar to that of our population. Oil burner mechanics are concentrated in States where oil is a major heating fuel. More than half work in Massachusetts, New Jersey, New York, Pennsylvania, Illinois, and Michigan. Similarly, gas burner mechanics are concentrated in States where gas is a major heating fuel. Almost half worked in Texas, California, Ohio, Michigan, and Illinois.

Training, Other Qualifications, and Advancement

Most air-conditioning, refrigeration, and heating mechanics start as helpers and acquire their skills by working for several years with experienced mechanics. The remainder learn through apprenticeship.

All new workers in these trades receive similar on-the-job training, lasting 4 to 5 years. They begin by doing simple tasks such as carrying materials, insulating refrigerant lines, or cleaning furnaces. Within a year, they learn to cut, braze, and solder pipe and tubing; within three, to install fittings and work with sheet metal. By the end of training, they are capable of checking circuits and installing burners and pumps.

In addition to on-the-job training, apprentices must have related classroom instruction in subjects such as math, blueprint reading, and basic construction and engineering concepts.

When hiring helpers or apprentices, employers prefer high school graduates with mechanical aptitude who have had courses in mathematics, physics, electronics, and blueprint reading. Good physical condition also is necessary because workers sometimes have to lift and move heavy equipment.

Many high schools and vocational schools offer basic mechanic courses, some of which are taught by members of local firms and organizations such as the Air-conditioning and Refrigeration Institute and the Petroleum Marketing Education Foundation. These courses may last from 2 to 3 years.

Employment Outlook

Employment of air-conditioning, refrigeration, and heating mechanics is expected to increase much faster than the average for all occupations through the mid-1980's. In addition to the job openings from employment growth, many openings will occur as experienced mechanics transfer to other fields of work, retire, or die.

Most openings will be for air-conditioning and refrigeration mechanics. An increase in household formation and rising personal incomes should result in a very rapid increase in the number of air-conditioned homes. Air-conditioning in schools, factories, and other buildings also is expected to increase. In addition, more refrigeration equipment will be needed in the production, storage, and marketing of food and other perishables.

Employment of furnace installers and gas burner mechanics is expected to follow the growth trends in the construction of homes and businesses. Employment of oil burner mechanics should also grow as customers have their heating systems serviced more frequently in order to conserve oil.

Earnings and Working Conditions

Depending on the area of the country and the experience of the worker, hourly rates for skilled air-conditioning, refrigeration, and heating mechanics ranged from about $6 to $10 in 1976, according to limited information. In comparison, the average hourly rate for production and nonsupervisory workers in private industry, except farming, was $4.87. Mechanics who worked on both air-conditioning and heating equipment frequently had higher rates of pay than those who worked on only one type of equipment. Starting rates for helpers and apprentices are about 55 to 65 percent of those paid to experienced workers; with experience, rates increase.

Most mechanics work a 40-hour week. However, during seasonal peaks they often work overtime or irregular hours. Air-conditioning and refrigeration mechanics are busiest during spring and summer, and heating mechanics are busiest during fall and winter. Most employers try to provide a full workweek the year round, but they may temporarily reduce hours or lay off some mechanics when seasonal peaks end. However, employment in most shops that service both air-conditioning and heating equipment is fairly stable throughout the year.

Mechanics sometimes are required to work at great heights when installing new equipment. They also may work in awkward or cramped positions. Hazards in this trade include electrical shock, torch burns, and muscle strains and other injuries from handling heavy equipment.

Sources of Additional Information

For more information about employment and training opportunities, contact the local office of the State employment service or firms that employ air-conditioning, refrigeration, and heating mechanics.

For pamphlets on career opportunities and training, write to:

Air-Conditioning and Refrigeration Institute, 1815 N. Fort Myer Dr., Arlington, Va. 22209. (The Institute prefers not to receive individual requests for large quantities of pamphlets.)

For information about training in oil heating systems, write to:

Petroleum Marketing Education Foundation, P. O. Box 11187, Columbia, S.C. 29211.

For career information about gas burner mechanics, write to:

American Gas Association, Inc., 1515 Wilson Blvd., Arlington, Va. 22209.

DRYWALL INSTALLERS AND FINISHERS

(D.O.T. 840.887 and 842.884)

Nature of the Work

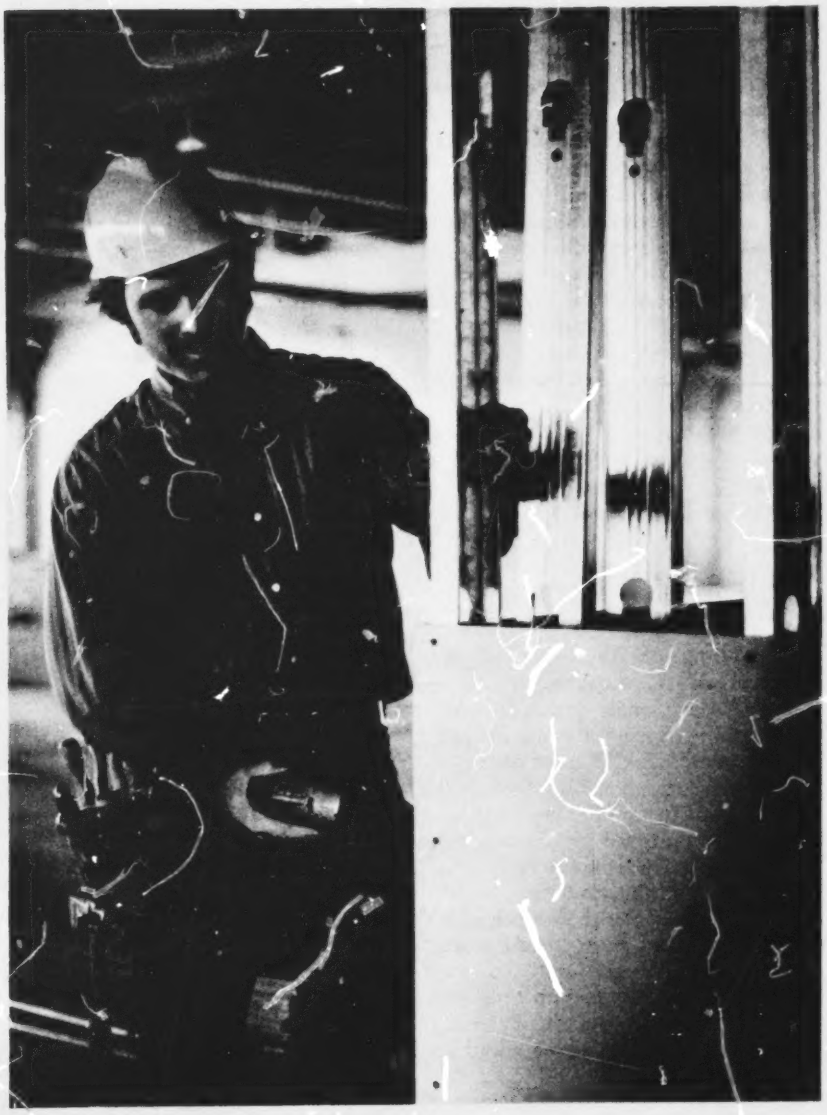
Developed as a substitute for wet plaster, drywall consists of a thin wall

of plaster sandwiched between two pieces of heavy paper. It is used today for walls and ceilings of most new homes because it saves both time and money compared to traditional construction using plaster.

Two new occupations have emerged in response to the widespread use of this construction material: drywall installers and drywall finishers. Installers fasten drywall panels to the framework inside houses and other buildings. Finishers do touchup work to get the panels in shape for painting.

Drywall panels are manufactured in standard sizes—for example, 4 feet by 12 feet. Thus, installers must measure and cut some pieces to fit in small spaces, such as above and below windows. They also saw holes in the panels for electric outlets, air-conditioning units, and plumbing. After making these alterations, installers apply glue to the wooden framework, press the panels against it, and nail them down. An installer usually is assisted by a helper because large panels are too heavy and cumbersome for one person to handle.

Some installers specialize in hanging drywall panels on metal framework in offices, schools, and other large buildings. Following plans that indicate the location of rooms and hallways, they saw metal rods and channels to size, bolt them together to make floor-to-ceiling frames, and attach the drywall panels to the frames with screws. The workers also erect suspended ceilings. They hang metal bands from wires that are embedded in the concrete ceiling. The installers run the bands horizontally across the room, crisscrossing them to form rectangular spaces for the ceiling panels.



High school courses in carpentry provide a helpful background for drywall work.

After the drywall has been installed, finishers fill joints between panels with a quick-drying paste. Using the wide, flat tip of a special knife, and brushlike strokes, they spread the paste into and along each side of the joint. Before the paste dries, workers use their knives to press a perforated paper tape into the paste and to scrape away excess paste. When the first application of paste is dry, finishers apply another to fill any depressions and to make a smooth surface. Nail and screw heads also are covered with this compound. Finishers sand these patched areas to make them as smooth as the rest of the wall surface. They also repair nicks and cracks caused by the installation of air-conditioning vents and other fixtures. Some finishers specialize in sanding, taping, or repair work.

Places of Employment

About 45,000 persons worked as drywall installers and finishers in 1976. Most worked for contractors that specialize in drywall construction; others worked for contractors that do all kinds of construction.

Installers and finishers are employed throughout the country, but are concentrated in urban areas. In many small towns, carpenters install drywall and painters finish it.

Training, Other Qualifications, and Advancement

Persons who become drywall installers or finishers usually start as helpers and learn most of their skills on the job. Some employers, in cooperation with unions, offer special

programs which supplement on-the-job training with a few hours of classroom instruction each week. Each program lasts about 2 years.

Installer helpers start by carrying materials, holding panels, and cleaning up debris. Within a few weeks, they are taught to measure, cut, and install panels. Eventually, they become experienced installers, capable of working quickly and without help.

Finish helpers begin with taping joints and touching up nail holes and scratches. They soon learn to install corner guards and to conceal openings around pipes. Near the end of their training, they learn to estimate costs of installing and finishing drywall.

Employers prefer high school graduates who are in good physical condition, but applicants with less education frequently are hired. High school or trade school courses in carpentry provide a helpful background for drywall work. Installers must be good at simple arithmetic.

After qualifying as an installer or finisher, a person who has leadership ability may become a supervisor within a few years. Some workers start their own drywall contracting businesses.

Employment Outlook

Employment of drywall workers is expected to grow much faster than the average for all occupations through the mid-1980's due to an increase in construction activity. Besides the workers hired to fill openings arising from this increased demand, many will be hired to replace those who retire, die, or take jobs in other occupations. Because construction activity fluctuates, however, the number of new workers needed may vary greatly from year to year.

Most job openings will be in metropolitan areas. Building contractors in small cities may not have enough business to hire full-time drywall workers.

Earnings and Working Conditions

According to limited information, drywall installers and finishers earned from $6.50 to $9 an hour in 1976. By comparison, all nonsupervisory and production workers in private industry, except farming, averaged $4.87 an hour.

Many contractors pay installers and finishers according to the amount of work they complete—for example, from 3 to 5 cents for each square foot of panel installed. In a day, the average drywall worker installs 35 to 40 panels, each 4 feet by 12 feet.

A 40-hour week is standard for installers and finishers, but they sometimes work longer. Those who are paid hourly rates receive premium pay for overtime. Unlike many construction workers, installers and finishers work indoors and do not lose time and pay when the weather is bad.

As in other construction trades, drywall work sometimes is strenuous. Installers and finishers spend most of the day on their feet, either standing, bending, stooping, or squatting. Installers have to lift and maneuver heavy panels. Hazards include the possibility of falls from ladders and injuries from power tools.

Some installers are members of the United Brotherhood of Carpenters and Joiners of America, and some finishers are members of the International Brotherhood of Painters and Allied Trades.

Sources of Additional Information

For details about job qualifications and training programs, write to:

International Association of Wall and Ceiling Contractors/Gypsum Drywall Contractors International, 1711 Connecticut Ave. NW., Washington, D.C. 20009.

National Joint Painting, Decorating, and Drywall Apprenticeship and Training Committee, 1709 New York Ave. NW., Washington, D.C. 20006.

ELECTRICIANS (CONSTRUCTION)

(D.O.T. 821.381, 824.281, and 829.281 and .381)

Nature of the Work

Heating, lighting, power, air-conditioning, and refrigeration components all operate through electrical systems that are assembled, installed, and wired by construction electricians. These workers also install electrical machinery, electronic equipment and controls, and signal and communications systems. (Maintenance electricians, who usually maintain the electrical systems installed by construction electricians, are discussed elsewhere in the *Handbook*.)

Construction electricians follow blueprints and specifications for most installations. To install wiring in factories and offices, they may bend, fit, and fasten conduit (pipe or tubing) inside partitions, walls, or other concealed areas. Workers also fasten to the wall small metal boxes that will house electrical devices such as switches.

To complete circuits between outlets and switches, they then pull insulated wires or cables through the conduit. They work carefully to avoid damaging any wires or cables. In lighter construction, such as housing, plastic-covered wire usually is used rather than conduit. In any case, electricians connect the wiring to circuit breakers, transformers, or other components. Wires are joined by twisting ends together with pliers and covering the ends with special plastic connectors. When additional strength is desired, they may use an electric "soldering gun" to melt metal onto the twisted wires then cover them with durable, electrical tape. When the wiring is finished, they test the circuits for proper connections and grounding.

For safety, electricians follow National Electrical Code specifications and procedures and, in addition, must comply with requirements of State, county, and municipal electrical codes.

Electricians generally furnish their own tools, including screwdrivers, pliers, knives, and hacksaws. Employers furnish heavier tools, such as pipe threaders, conduit benders, and most test meters and power tools.

Places of Employment

Most of the 260,000 construction electricians employed in 1976 worked for electrical contractors. Many others were self-employed

A 4-year apprenticeship program is the best way to learn the electrician trade.

contractors. Construction electricians are employed throughout the country, but are concentrated in industrialized and urban areas.

Training, Other Qualifications, and Advancement

Most training authorities recommend the completion of a 4-year apprenticeship program as the best way to learn the electrical trade. Compared to most other construction trades, electricians have a higher percentage of apprentice-trained workers. However, some people learn the trade informally by working for many years as electricians' helpers. Many helpers gain additional knowledge through trade school or correspondence courses, or through special training in the Armed Forces.

Apprenticeship programs are sponsored through and supervised by local union-management committees. These programs provide 144 hours of classroom instruction each year in addition to comprehensive on-the-job training. In the classroom, apprentices learn blueprint reading, electrical theory, electronics, mathematics, and safety and first-aid practices. On the job, under the supervision of experienced electricians, apprentices must demonstrate mastery of electrical principles. At first, apprentices drill holes, set anchors, and set up conduit. In time and with experience, they measure, bend, and install conduit, as well as install, connect, and test wiring. They also learn to set up and draw diagrams for entire electrical systems.

Beginners who are not apprentices can pick up the trade informally in a variety of ways. For example, some begin working in manufacturing plants piecing together electrical components. Others start in maintenance where they learn about circuit breakers, fuses, switches, and other electrical devices. Later, they change jobs and broaden their knowledge by working as helpers for experienced electricians. While learning to install conduit, connect wires, and test circuits, helpers are also taught good safety practices.

All applicants should be in good health and have at least average physical strength. Good color vision is important because workers frequently must identify electrical wires by color. Also important are agility and dexterity. Applicants for apprentice positions must be at least 18 years old and usually must be a high school or vocational school graduate with 1 year of algebra. Courses in electricity, electronics, mechanical drawing, science, and shop provide a good background.

To obtain a license, which is necessary for employment in some cities, an electrician must pass an examination which requires a thorough knowledge of the craft and of State and local building codes.

Experienced construction electricians can advance to supervisors, superintendents, or contract estimators for contractors on construction jobs. Many electricians start their own contracting businesses. In most large urban areas, a contractor must have an electrical contractor's license.

Employment Outlook

Employment of construction electricians is expected to increase faster than the average for all occupations through the mid-1980's. As population and the economy grow, more electricians will be needed to install electrical fixtures and wiring in new and renovated homes, offices, and other buildings. In addition to jobs created by employment growth, many openings will arise as experienced electricians retire, die, or leave the occupation for other reasons.

While employment in this field is expected to grow over the long run, it may fluctuate from year to year due to ups and downs in construction activity. When construction jobs are not available, however, electricians may be able to transfer to other types of electrical work. For example, they may find jobs as maintenance electricians in factories or as electricians in shipbuilding or aircraft manufacturing.

Earnings and Working Conditions

According to a survey of metropolitan areas, union wage rates for electricians averaged $10.33 an hour in 1976. This was about twice the average wage of nonsupervisory and production workers in private industry, except farming. Because the seasonal nature of construction work affects electricians less than workers in most building trades, their annual earnings also tend to be higher.

Apprentice wage rates start at from 40 to 50 percent of the rate paid to experienced electricians and increase periodically.

Construction electricians are not required to have great physical strength, but they frequently must stand for long periods and work in cramped quarters. Because much of their work is indoors, electricians are less exposed to unfavorable weather than are most other construction workers. They risk electrical shock, falls from ladders and scaffolds, and blows from falling objects. However, safety practices have helped to reduce the injury rate.

A large proportion of construction electricians are members of the International Brotherhood of Electrical Workers.

Sources of Additional Information

For details about electrician apprenticeships or other work opportunities in this trade, contact local electrical contractors; a local chapter of the National Electrical Contractors Association; a local union of the International Brotherhood of Electrical Workers; a local union-management apprenticeship committee; or the nearest office of the State employment service or State apprenticeship agency. Some local employment service offices screen applicants and give aptitude tests.

For general information about the work of electricians, contact:

International Brotherhood of Electrical Workers, 1125 15th St. NW., Washington, D.C. 20005.

National Electrical Contractors Association, 7315 Wisconsin Ave. NW., Washington, D.C. 20014.

National Joint Apprenticeship and Training Committee for the Electrical Industry, 9700 E. George Palmer Hwy., Lanham, Md. 20801.

FLOOR COVERING INSTALLERS

(D.O.T. 299.381 and 864.781)

Nature of the Work

Floor covering installers (also called *floor covering mechanics*) install and replace carpet or resilient floor covering materials such as tile, linoleum, and vinyl sheets. These workers install coverings over floors made of wood, concrete, or other materials. They generally specialize in either carpet or resilient floor covering installation, although some do both types.

Before putting down resilient covering, such as vinyl tile, installers first inspect the floor to be sure that it is firm, dry, smooth, and free of dust or dirt. Some floors have to be prepared for covering. For example, installers may sand a rough or painted floor and fill cracks and indentations. An extremely uneven floor may be resurfaced with wood or other materials.

On newly poured concrete floors or floors laid over earthwork, installers test for moisture content. If the moisture is too great, they may suggest postponing installation of floor covering or recommend a covering technique suited to the floor's condition.

Resilient-flooring installers measure and mark off the floor according to a plan. The plan may be architectural drawings that specify every detail of the covering design, or a simple, verbal description by the customer. When the plan is complet-

Floor covering installer laying resilient tile.

ed, installers, often assisted by apprentices or helpers, cut, fit, and glue the flooring into place. It must be carefully fit, particularly at door openings, along irregular wall surfaces, and around fixtures, such as columns or pipes. Installers must take special care also in cutting out and setting in decorative designs. After the flooring is in place, they may run a roller over it to insure good adhesion.

Carpet installers, like the installers of resilient coverings, first inspect the floor to determine its condition. Then they plan the layout after allowing for expected traffic patterns so that best appearance and long wear will be obtained.

For wall-to-wall carpet, installers lay underlayment—a 1/2 to 1 inch thick, foam rubber pad—that is cut slightly smaller than the entire floor. Next, they roll out, measure, mark, and cut the carpet, allowing for 3 to 4 inches of extra carpet on each side. This provides some leeway for mistakes. Workers then lay the carpet and stretch it to fit evenly against the floor and snugly against each wall and door threshold. With the carpet stretched, the excess around the perimeter is cut to fit the room precisely. To hold the carpet in place, workers either tack or tape each edge of the carpet to the floor.

For precut and seamed carpet, installers simply lay a foam rubber pad on the floor and roll the carpet over the slightly smaller pad. To hold the pad and carpet in place, installers may apply tape that has adhesive on both sides to the bottom edges of the carpet.

Places of Employment

An estimated 85,000 floor covering installers were employed in 1976. About four-fifths worked primarily with carpet, and the remainder with resilient flooring.

Most installers worked for flooring contractors. Many others worked for retailers of floor covering and home alteration and repair contractors. About 1 out of 4 floor covering installers was self-employed, a higher proportion than the average for all building trades.

Installers are employed throughout the Nation, but most are concentrated in urban areas that have high levels of construction activity.

Training, Other Qualifications, and Advancement

The vast majority of floor covering installers learn their trades informally on the job by working as helpers to experienced installers. Most others learn through formal apprenticeship programs, which include on-the-job training as well as related classroom instruction.

Informal training programs usually are sponsored by individual contractors and generally take about 1 1/2 years. Helpers begin with simple assignments. Helpers on resilient flooring jobs carry materials and tools, prepare floors for the tile, and help with its installation. Carpet helpers install tackless stripping and padding, and help stretch newly installed carpet. With experience, helpers in either trade take on more difficult assignments, such as measuring, cutting, and fitting the materials to be installed.

Some contractor-sponsored programs and apprenticeship programs provide comprehensive training that covers both carpet and resilient flooring work.

Applicants for helper or apprentice jobs should be at least 16 years old, mechanically inclined, and licensed to drive. A high school education is preferred, though not necessary. Courses in general mathematics and shop may provide a helpful background.

Floor covering installers may advance to supervisors or installation managers for large floor laying firms. Some installers become salespersons or estimators. Installers also may go into business for themselves.

Employment Outlook

Employment of floor covering installers is expected to increase about as fast as the average for all occupations through the mid-1980's. In addition to job openings resulting from employment growth, many openings will arise as experienced installers retire, die, or leave the occupation for other reasons.

Employment of floor covering installers is expected to increase mainly because of the expected expansion in construction and the more widespread use of resilient floor coverings and carpeting. In many new buildings, plywood will continue to replace hardwood floors, thus making wall-to-wall carpet or resilient floors a necessity. Carpet and resilient flooring also will continue to be used extensively in renovation work. Moreover, versatile materials and colorful patterns will contribute to the growing demand for floor coverings.

Most job opportunities will be for carpet installers and workers who can install both carpet and resilient flooring. Fewer opportunities will arise for workers who can install only resilient flooring because this is a relatively small field.

Earnings and Working Conditions

Information from a limited number of firms indicates that experienced floor covering installers earned between $6.25 and $9 per hour in 1976. Starting wage rates for apprentices and other trainees usually are about half of the experienced worker's rate.

Most installers are paid by the hour. In some shops, part of the pay may be in bonuses. In others, installers receive a monthly salary or are paid according to the amount of work they do.

Installers generally work regular daytime hours. Particular circumstances, however, such as installing a floor in a store or office, may require work during evenings or weekends.

Unlike many construction workers, floor covering installers usually do not lose time due to weather conditions. During the winter, most work is done in heated buildings. The jobs are not hazardous, but installers may get injuries from lifting heavy materials or from working in a kneeling position for long periods. Most injuries can be avoided if proper work procedures are followed.

Many floor covering installers belong to unions, including the United Brotherhood of Carpenters and Joiners of America, and the International

Brotherhood of Painters and Allied Trades.

Sources of Additional Information

For details about apprenticeships or work opportunities, contact local flooring contractors or retailers; locals of the unions previously mentioned; or the nearest office of the State apprenticeship agency or the State employment service.

For general information about the work of floor covering installers, contact:

Carpet and Rug Institute, P.O. Box 2048, Dalton, Ga. 30720.

Resilient Floor Covering Institute, 1030 15th St. NW., Suite 350, Washington, D.C. 20005.

GLAZIERS

(D.O.T. 865.781)

Nature of the Work

Construction glaziers cut and install all types of building glass. For some jobs, the glass is precut and ready to install. For other jobs, glass must be cut before being installed.

To prepare the glass for cutting, glaziers measure and mark the glass to fit the window opening, then rest the glass either on edge or flat against a carpeted table. To help the cutting tool move smoothly across the glass, workers sometimes brush on a thin layer of oil along the line of the intended cut.

Glaziers cut glass with a special tool that has a very hard metal wheel about 1/6 inch in diameter. Using a "straightedge" as a guide, the glazier presses the cutter's wheel firmly to the glass, guiding and rolling it carefully over the surface. This creates a cut on and just below the surface. Immediately after cutting, the glazier presses on the small end, thereby causing the glass to break cleanly along the cut.

Glaziers may need the help of a crane when installing a large, heavy piece of glass. In all cases, however, since there is a risk of shattering the glass, glaziers use their hands to guide the glass carefully to the opening and to position the glass precisely in its frame.

Glaziers secure glass in an opening with materials such as putty, rubber gaskets, metal clips, and metal or wood molding. When using putty, which is similar to very soft taffy, workers first spread it neatly against and around the edges of the molding on the inside of the opening. Next, they install the glass. With it pressed against the putty on the inside molding, workers then screw or nail outside molding that loosely holds the glass in place. To hold it firmly, they pack the space between the molding and the glass with putty, then trim any excess putty with a putty knife.

Glaziers sometimes use a rubber gasket—a very heavy molded rubber hose with a split running its length—to secure glass. They first glue the gasket around the perimeter within

The popularity of glass in building design will stimulate the demand for glaziers.

the opening, then set the glass into the split side of the gasket, causing it to clamp to the edges of the glass and hold it firmly in place.

When metal clips and molding are used to secure glass, glaziers first secure the molding, then force springlike metal clips between the glass and the molding. The clips exert pressure on the molding and the glass, thereby keeping it firmly in place.

Glaziers also install glass doors, mirrors, and steel sash.

In addition to handtools such as glasscutters and putty knives, glaziers use power tools, such as cutters and grinders.

Places of Employment

About 10,000 persons worked as construction glaziers in 1976. Most worked for glazing contractors engaged in new construction, alteration, and repair. Others worked for government agencies or businesses that do their own construction work.

Glaziers work throughout the country but jobs are concentrated in metropolitan areas. Glaziers occasionally may travel to work for a day or two in small outlying towns where few people, if any, are equipped and qualified to install glass in commercial buildings such as stores.

Training, Other Qualifications, and Advancement

The majority of construction glaziers learn the trade through a 4-year apprenticeship program. Others learn the trade informally, on the job, by assisting experienced workers.

Apprenticeship programs, usually sponsored by local union-management committees, consist of on-the-job training as well as 144 hours of classroom instruction each year. Some apprenticeship programs also require a comprehensive home study course.

On the job, apprentices learn to use the tools and equipment of the trade; handle, measure, cut, and install glass; cut and fit moldings; and install and balance glass doors. In the classroom, they are taught mathematics, blueprint reading, general construction techniques, safety practices, and first-aid.

Those who learn this trade informally usually start by carrying glass and cleaning up debris in large glass shops. They often have the opportunity to practice their cutting techniques on discarded glass. After a year or so, they may have an opportunity to cut glass for a job. Eventually, helpers assist experienced workers on a simple installation job. Learning the trade this way may take considerably longer than through apprenticeship.

Applicants for apprenticeships or helper positions should be in good physical condition and licensed to drive. Persons applying for helper positions will find that employers prefer high school or vocational school graduates. Applicants for apprenticeships must be at least 18 years old and have a high school diploma or its equivalent. Courses in general mathematics, blueprint reading or mechanical drawing, general construction, and shop provide a helpful background.

Glaziers who have leadership ability may advance to supervisory jobs. Some glaziers become contractors.

Employment Outlook

Employment of construction glaziers is expected to increase faster than the average for all occupations through the mid-1980's. Besides the jobs resulting from employment growth, many openings will arise as experienced glaziers retire, die, or leave the occupation for other reasons. The number of openings may fluctuate from year to year, however, because employment in this trade is sensitive to changes in construction activity.

Over the long run, population and business growth will create a rising demand for new residential and commercial buildings, such as apartments, offices, and stores. Since glass will continue to be popular in building design, the demand for glaziers to install and replace glass also will grow.

Employment opportunities should be greatest in metropolitan areas, where most glazing contractors are located.

Earnings and Working Conditions

In 1976, union construction glaziers in metropolitan areas had estimated average wages of $9.25 an hour, or about twice the average hourly wage for production or nonsupervisory workers in private industries, except farming. Apprentice wage rates usually start at 50 percent of the rate paid to experienced glaziers and increase periodically. Yearly earnings of glaziers and apprentices, however, generally are slightly lower than hourly rates would indicate because the annual number of hours they work can be adversely affected by poor weather and fluctuations in construction activity.

Glaziers may be injured by glass edges or cutting tools, falls from scaffolds, or from lifting glass. To reduce injuries, employers and unions emphasize safety training.

Many glaziers employed in construction are members of the International Brotherhood of Painters and Allied Trades.

Sources of Additional Information

For more information about glazier apprenticeships or work opportunities, contact local glazing or general contractors; a local of the International Brotherhood of Painters and Allied Trades; a local joint union-management apprenticeship agency; or the nearest office of the State employment service or State apprenticeship agency.

For general information about the work of glaziers, contact:

International Brotherhood of Painters and Allied Trades, 1750 New York Ave. NW., Washington, D.C. 20006.

INSULATION WORKERS

(D.O.T. 863.381, .781, and .884)

Nature of the Work

Properly insulated homes and buildings reduce fuel costs by preventing excessive loss of cool air on warm days and hot air on cold days. Meat storage rooms, steam pipes.

and boilers are other examples where the wasteful transfer of heat to or from the space inside can be minimized by insulation. Selecting the proper material and method of installation is the responsibility of insulation workers.

Insulation workers—sometimes called applicators—may paste, wire, tape, or spray insulation to an appropriate surface. When covering a steam pipe, for example, insulation workers may cut a tube of insulation to the necessary length, stretch it open along a cut which runs the length of the tube, and then slip it over the pipe. To secure the insulation they wrap and fasten wire bands around it, tape it, or wrap a cover of tar paper, cloth, or canvas over it and then sew or staple the cover in place. Care is required to cover joints completely.

When covering a wall or other flat surface, workers may use a hose to spray foam insulation onto a wire mesh. The wire mesh provides a rough surface to which the foam can cling and adds strength to the finished wall. If desired, workers apply a final coat for a finished appearance.

In some places, such as attics which do not require either wire mesh for adhesion or a final coat for appearance, applicators use a compressor to "blow-in" the insulation. "Blowing in" insulation is a simple task. The worker fills the machine with shredded fiberglass insulation, allows the compressor to force the insulation through a hose, and controls the direction and flow of the insulation until the required amount is installed.

Insulation workers use common handtools—trowels, brushes, scissors, sewing equipment, and stapling guns. Powersaws, as well as handtools, are used to cut and fit insulating materials.

Compressors for "blowing-in" or for "spraying-on" insulation also may be used. In using these tools, applicators may have to bend or squat while working on ladders or on scaffolds in dimly lit and sometimes very dusty areas.

Places of Employment

About 30,000 insulation workers were employed in 1976. Most worked for insulation contractors. Others were employed to alter and maintain insulated pipework in chemical factories, petroleum refineries, power plants, and similar structures which have extensive steam installations for power, heating, and cooling. Some large firms which have cold-storage facilities also employ these workers for maintenance and repair.

Training, Other Qualifications, and Advancement

Almost all insulation workers learn their trade through either informal on-the-job training or a formal 4-year "improvership" program; both of these programs stress conservation and safety. A trainee in an informal on-the-job program, usually provided by and paid for by an insulation contractor, is assigned to an experienced insulation worker for instruction and supervision. A trainee begins with simple tasks, such as "blowing-in" insulation, supplying insulation material to experienced workers, or holding the material while they fasten it in place. In about 6 to 8 months, assignments become more complex, and within a year a trainee usually learns to measure, cut, fit, and install various types of insulation. With experience, the trainee receives less supervision, more responsibility, and higher pay.

Trainees who receive informal instruction usually learn to specialize in only three or four types of installation. In contrast, trainees in 4-year "improvership" programs—much like the apprenticeship programs of other trades—receive in-depth instruction in almost all phases of insulation work. The in-depth instruction is provided by and paid for by a joint committee of local insulation contractors and the local union of insulation applicators. The committee determines the need for "improverships," screens and tests applicants, and ensures the availability of proper training programs. Programs consist of on-the-job training as well as classroom instruction, and trainees must pass practical and written tests to demonstrate a knowledge of the trade.

For entry jobs, insulation contractors prefer high school graduates who are in good physical condition and licensed to drive. High school courses in blueprint reading, shop math, and general construction provide a helpful background.

Applicants seeking 4-year "improvership" positions must have a high school diploma or its equivalent, and be at least 18 years old. Application can be made through local contractors, unions, or a joint committee.

Skilled insulation workers may advance to supervisor, shop superintendent, or insulation contract estimator, or may open an insulation contracting business.

Employment Outlook

Employment of insulation workers is expected to grow much faster than the average for all occupations through the mid-1980's. In addition to jobs from employment growth, several hundred openings will arise annually from the need to replace workers who transfer to other occupations, retire, or die.

More workers will be needed to install energy-saving insulation in new homes and businesses. Insulation for boilers and pipes in new factories and power plants also will stimulate employment growth. Moreover, old buildings that need extra insulation to save fuel will add to employment requirements.

More workers will be needed to install energy-saving insulation in homes and businesses.

Employment opportunities will be best in metropolitan areas, where most insulation contractors are located. In small towns much of the insulation work is done by persons in other trades, such as heating and air-conditioning installers, carpenters, and drywall installers, rather than by insulation workers.

Earnings and Working Conditions

Union insulation workers in metropolitan areas had estimated average wages of $9.75 an hour in 1976, slightly higher than the average for all union building trades workers. Apprentice wage rates start about half the rate paid to experienced workers and increase periodically.

According to limited information, experienced nonunion insulation workers earn from $200 to $300 per week. Nonunion trainees earn from $120 to $140 per week.

Insulation workers spend most of the workday on their feet, either standing, bending, stooping, or squatting. Sometimes they work from ladders or in tight spaces. Removing old insulation before installing new materials is often dusty and dirty. Tearing out asbestos—at one time the most common form of insulation but rarely used today—can be very dangerous to the workers' health unless they follow proper safeguards.

A large proportion of the workers in this trade are members of the International Association of Heat and Frost Insulators and Asbestos Workers.

Sources of Additional Information

For information about insulation workers' improvership programs or other work opportunities in this trade, contact a local insulation contractor; a local of the union mentioned above; or the nearest office of the State employment service or State apprenticeship agency.

LATHERS

(D.O.T. 842.781)

Nature of the Work

What makes cement cling to a ceiling? Lath does. If properly installed, lath creates a firm support to which wet cement, plaster, or stucco will hold fast to form ceilings and walls. The one who installs lath is called a lather.

Until the last century, lath was made exclusively of wood. Since then, metal and gypsum have replaced wood because of their versatility, strength, and fire proofing properties. Metal lath comes in different forms, but it is usually wire mesh. Gypsum lath comes in 1/2 inch thick sheets, ranging from 1 1/4 feet by 4 feet to 4 feet by 8 feet.

Each type of lath holds cement, plaster, or stucco in a particular way. For example, wet plaster penetrates openings in the lath and is held in place mechanically. When applied to gypsum lath, however, chemicals in the wet plaster react with other chemicals on the lath's surface, bonding the materials together.

Lathers use various methods of installation depending on the purpose of the job, the kind of building, and the type of lath specified. On walls and ceilings, lathers usually clip, nail, screw, staple, or wire-tie the lath directly to the building's framework. On cinder block or masonry walls, it is necessary to build a light metal or wood frame, called furring, onto the building's structure. Then they attach the lath to the fur-

Lather wire-ties metal lath.

ring. While installing lath, workers cut openings in it for electrical outlets and water pipes.

Lathers install a special wire mesh reinforcement on inside angles and corners or walls to prevent cracking. On outside or exposed corners, they attach a corner support that provides protection and strength.

Sometimes lathers install two layers of lath. For example, when stucco (a mixture of portland cement and sand) is to be applied over a wood framework, workers may install two layers of wire mesh, separated by a layer of felt, to serve as a base for the stucco.

In ornamental work or curved surface work, workers build a frame approximating the desired shape, and then attach the lath to the frame.

Lathers also install suspended ceilings. They wire-tie metal bands to rods or wires attached to the structure above. Installers run the metal bands horizontally across the room, crisscrossing them to form rectangular spaces. These spaces can serve to hold either ceiling panels or lath to which plaster is applied.

To do their work, lathers use drills, hammers, hacksaws, shears, wirecutters, hatchets, stapling machines, and power-actuated fastening devices.

Places of Employment

Most lathers—who numbered about 20,000 in 1976—work for lathing and plastering contractors on new residential, commercial, or industrial construction. They also work on modernization and alteration jobs. A relatively small number of lathers are employed outside the construction industry; for example, some make the lath backing for plaster display materials or scenery.

Training, Other Qualifications, and Advancement

Most training authorities recommend apprenticeship as the best way to learn lathing. However, many lathers, particularly in small communities, have acquired their skills informally by working as helpers, observing or being taught by experienced lathers.

Apprenticeship programs usually last a minimum of 2 years, and are usually sponsored by various local joint labor-management committees. All programs include on-the-job training; some also include classroom instruction. On the job, under the guidance of an experienced worker, apprentices learn to use the tools and materials of the trade. Initially, they work on simple tasks, such as nailing gypsum lath to wall partitions. After gaining experience, they advance to more complex jobs, such as installing wire mesh on curved surfaces. Classroom instruction includes applied mathematics, blueprint reading, sketching, estimating, basic welding, and safety.

Informal on-the-job training provides only the essential knowledge needed by trainees. They start with easy jobs such as carrying materials or holding lath in place while experienced workers secure it. Trainees soon learn to clip, nail, staple, and wire-tie the lath—first, to walls and later, to floors and ceilings.

Generally, applicants for apprentice or helper should be at least 16 years old, in good physical condition, and licensed to drive. Apprenticeship applicants are usually required to have a high school or vocational school education, or the equivalent. Courses in general mathematics and mechanical drawing can provide a helpful background. Aptitude tests often are given to determine manual dexterity and mechanical ability.

Some experienced lathers may become supervisors. Others may be able to start their own lath contracting business.

Employment Outlook

Employment of lathers is expected to grow about as fast as the average for all occupations through the mid-1980's. In addition to growth, additional jobs will result from the need to replace workers who retire, die, or leave the occupation for other reasons. Because the number of lathers is small, however, there will be relatively few job openings annually.

Growth in population and business activity are expected to stimulate the construction of new, and the renovation of old, buildings. As a result, more lathers will be needed to construct some of the more expensive new buildings, to renovate older buildings, and to fill the demand for lath and plaster on curved surfaces where drywall is not a practical substitute.

Earnings and Working Conditions

In 1976, union lathers in metropolitan areas had estimated average wages of $9.80 an hour. This is about twice the average wage of nonsupervisory and production workers in private industry, except farming. Apprentices start at about 50 percent of the wage rate paid to experienced lathers and receive more as they gain experience. However, yearly earnings for lathers and apprentices generally are lower than hourly rates would indicate because the annual number of hours that they work can be adversely affected by poor weather and fluctuations in construction activity.

Although lathers' work is not strenuous, it does require standing, squatting, or working overhead for long periods. Workers can be injured by falls from scaffolds or by cuts from various working materials or tools.

A large proportion of lathers are members of The Wood, Wire and Metal Lathers International Union.

Sources of Additional Information

For information about lathers' apprenticeships or other work opportunities in the trade, contact a local lathing or plastering contractor; a local of the Wood, Wire and Metal Lathers International Union; a local joint labor-management apprenticeship committee; or the nearest office of the State employment service or apprenticeship agency.

For general information about the work of lathers, contact:

International Association of Wall and Ceiling Contractors, Gypsum Drywall Contractors International, 1711 Connecticut Ave. NW., Washington, D.C. 20009.

National Lathing Industries Joint Apprenticeship Program, 815 16th St. NW., Washington, D.C. 20006.

PAINTERS AND PAPERHANGERS

(D.O.T. 840.381, .781 and .844, and 841.781)

Nature of the Work

Painting and paperhanging are separate, skilled trades although some people do both types of work. Painters apply paint, varnish, and other finishes to decorate and protect building surfaces. Paperhangers cover walls and ceilings of rooms with decorative wallpaper, fabric, vinyl, or similar materials.

Painters sand or scrape away old paint from the surface to be painted so that paint will adhere properly. If the paint is difficult to remove, they loosen it with special materials or equipment before sanding. They also remove grease, fill nail holes and cracks, sandpaper rough spots, and brush off dust. When painting new surfaces, they cover them with a primer or sealer to make a suitable surface for the finish coat.

Painters must be skilled in handling brushes and other painting tools so that they can apply paint thoroughly, uniformly, and rapidly to any type of surface such as wood, concrete, metal, masonry, plastic, or drywall. They must be able to mix paints and match colors, using a knowledge of paint composition and color harmony. They also must know the characteristics of common types of paints and finishes from the standpoints of durability, suitability, and ease of handling and application.

Painters often use rollers or spray guns instead of brushes. Rollers are used on even surfaces such as walls and ceilings. Spray guns are used on surfaces that are difficult to paint with a brush, such as cinder block and metal fencing. Both rollers and spray guns permit faster painting.

Painters also erect scaffolding, including "swing stages" (scaffolds suspended by ropes or cables attached to roof hooks) and "bosun chairs" (a device somewhat like a child's swing), which they use when working on tall buildings and similar structures.

Generally, painters only paint. Paperhangers, however, both paint and hang wallpaper. As a result, paperhangers require more training and additional skills.

The first step in paperhanging is to prepare the surface to be covered. Paperhangers apply "sizing," a material that seals the surface and enables the paper to stick better. In redecorating, they may have to remove old paper by wetting it with water-soaked sponges or—if there are many layers—by steaming. Frequently, it is necessary for paperhangers to patch holes with plaster.

After carefully positioning the patterns to match at the ceiling and baseboard, paperhangers measure the area to be covered and cut a length of wallpaper from the roll. They then apply paste to the strip of paper, place it on the wall, and smooth it by hand or with a brush. They cut and fit edges at the ceiling and base, and smooth seams between strips with a roller or other special tool. They inspect the paper for air bubbles and other imperfections in the work. Air bubbles are removed by smoothing the paper strip toward the outer edges. When working with wall coverings other than paper, such as fabric or vinyl, paperhangers follow the same general procedure.

Places of Employment

About 410,000 painters and 35,000 paperhangers were employed in 1975. Many worked for contractors engaged in new construction, repair, alteration, or modernization work. Hotels, office buildings, shipyards, manufacturing firms, schools, and other organizations that own or manage extensive property holdings also employed maintenance painters.

A high proportion of workers in these trades are in business for themselves. About one-fourth of the painters and more than half of the

Painters make up one of the largest building trades.

paperhangers are self-employed. In comparison, only one-tenth of all building trades workers are self-employed.

Training, Other Qualifications, and Advancement

Opportunities to learn painting and paperhanging range from formal apprenticeship to informal, on-the-job instruction.

Most training authorities recommend the completion of a formal apprenticeship as the best way to become a painter or paperhanger. However, apprenticeship opportunities are very limited, and new workers generally begin as helpers to experienced painters. Very few informal training programs exist for paperhanger trainees because there are very few paperhangers and most work alone. As a result, a larger percentage of paperhangers than painters are trained through apprenticeship.

The apprenticeship for painters and paperhangers generally consists of 3 years of on-the-job training, in addition to 144 hours of related classroom instruction each year. Apprentices receive instruction in subjects such as color harmony; use of tools; surface preparation; cost estimating; paint mixing and matching; and safety. They also learn the relationship between painting and paperhanging and the work performed by the other building trades.

On-the-job instruction, unlike the apprenticeship, has neither a set period of training nor related classroom instruction. Under the direction of experienced painters, trainees carry supplies, erect scaffolds, and do other simple tasks while they learn about the different kinds of paint and painting equipment. Within a short time, trainees learn to prepare metal, wood, and other surfaces for painting; to mix paints; and to paint with a brush, roller, and sprayer. Near the end of their training, they learn decorating concepts, color coordination, and cost-estimating techniques.

Applicants for apprentice or helper jobs generally must be at least 16 years old and in good physical condition. A high school or vocational school education is preferred, although not essential. Courses in chemistry and general shop are useful. Applicants should have manual dexterity and a good color sense. They cannot be allergic to fumes from paint or other materials used in these trades.

Painters and paperhangers may advance to jobs as cost estimators for painting and decorating contractors. Some may become superintendents on large contract painting jobs, or they may establish their own painting and decorating businesses.

Employment Outlook

Employment of painters is expected to grow about as fast as the average for all occupations through the mid-1980's. Replacement needs will create more job openings than growth. Many new workers will be hired to replace experienced painters who retire, die, or leave their jobs for other reasons. The number of job openings, however, may vary greatly from year to year as well as within any given year because the demand for painters is sensitive to fluctuations in construction activity caused by economic and seasonal conditions.

Over the long run, population and business growth will create a rising demand for new houses and buildings and more workers will be needed to paint these structures. Additional workers also will be hired to repaint existing structures.

Employment of paperhangers is expected to increase much faster than the average for all occupations through the mid-1980's. The demand for these workers should be stimulated by the rising popularity of wallpaper and more durable wall coverings such as vinyl. Since this is a relatively small trade, however, job openings for paperhangers will be far less numerous than those for painters.

Earnings and Working Conditions

Based on a survey of metropolitan areas, union hourly rates for painters and paperhangers averaged about $9.25 in 1976. In comparison, the average rate for experienced union workers in all union building trades was $9.47 an hour while production workers in manufacturing as a whole averaged $4.87 an hour. Annual incomes for some painters, particularly those on outside jobs, may not be as high as hourly rates would indicate because some worktime is lost due to bad weather and occasional unemployment between jobs.

Hourly wage rates for apprentices usually start at 50 percent of the rate paid to experienced workers and increase periodically until the full rate of pay is reached at the completion of apprenticeship.

Painters and paperhangers must stand for long periods. Their jobs also require a considerable amount of climbing and bending. A painter must have strong arms because much of the work is done with arms raised overhead. Painters and paperhangers risk injury from slips or falls off ladders and scaffolds. However, the injury rate for employees of painting, paperhanging, and decorating contractors in the construction industry has been significantly lower than the average for contract construction as a whole.

A large proportion of painters and paperhangers are members of the International Brotherhood of Painters and Allied Trades. A few are members of other unions.

Sources of Additional Information

For details about painting and paperhanging apprenticeships or other work opportunities in these trades, contact local painting and decorating contractors; a local of the International Brotherhood of Painters and Allied Trades; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or State employment service.

For general information about the work of painters and paperhangers, contact:

International Brotherhood of Painters and Allied Trades, 1750 New York Ave. NW., Washington, D.C. 20006.

Painting and Decorating Contractors Association of America, 7223 Lee Hwy., Falls Church, Va. 22046.

National Joint Painting, Decorating, and Drywall Finishing Apprenticeship and Training Committee, 1709 New York Ave. NW., Suite 110, Washington, D.C. 20006.

PLASTERERS

(D.O.T. 842.381 and .781)

Nature of the Work

Plasterers finish interior walls and ceilings with plaster coatings that form fire-resistant and relatively soundproof surfaces; they apply durable cement plasters or stucco to exterior surfaces. Plasterers also cast ornamental designs in plaster.

To interior surfaces such as cinder block or gypsum lath, plasterers apply two coats of plaster. The first or "brown" coat is a heavy, brown mixture; the second or "finish" coat a thin, pasty plaster. However, when the foundation consists of metal lath (a supportive wire mesh), plasterers apply a preparatory coat to the lath.

When applying a preparatory or "scratch" coat, plasterers either spray or use a trowel (a flat, 4 inch by 10 inch, metal plate with a handle) and wavelike motions to spread a thick, gritty plaster into and over the metal lath. Before the plaster on the lath dries, workers scratch its already uneven surface with a rakelike tool, producing ridges so the "brown" coat will cling tightly.

For the first or "brown" coat—whether applied to a scratch coat, cinder block or gypsum lath—workers prepare a thick, but smooth plaster. Workers either spray or trowel this mixture onto the surface, pushing plaster into cracks and holes, and then smoothing the plaster to an even surface for finishing.

For the finish coat, plasterers prepare a thin plaster of very fine granules. They usually hand trowel this mixture very quickly onto the "brown" coat to produce a very thin, very smooth finish for a ceiling or wall.

Plasterers create decorative surfaces as well. For example, while the final coat is still moist, they press firmly against the surface with a brush and use a circular hand motion to create decorative swirls.

Plastering requires considerable standing, stooping, and lifting.

For exterior work, plasterers apply a scratch coat to wire lath in the same way that they plaster interior surfaces. To the exterior scratch coat, workers usually apply a gritty mixture of white cement and sand—called stucco—to produce a durable final coat. As an alternative, they plaster an extra heavy mixture over the scratch coat, then embed marble or gravel chips about halfway into the mixture, thus achieving a uniform, pebble like surface.

Plasterers sometimes do complex decorative and ornamental work. For example, they may mold intricate designs for the walls and ceilings of public buildings. To make these designs, plasterers mix a special plaster, pour it into a mold, and allow time for drying. When these are dry, workers remove the molded plaster and paste it to the desired surface. Plasterers who do this work must follow blueprints and other specifications furnished by architects.

Plasterers use many special tools. They hold the plaster mixture on a hawk (a light metal plate with a handle) and apply the wet mixture with a trowel. Smoothing and finishing are done with straightedges, bevel edges, rods, floats, and other handtools. They also may use spray machines to apply plaster on both base and finish coats.

Places of Employment

Plasterers—who numbered about 24,000 in 1976—worked mostly on new construction and alteration work, particularly where special architectural and lighting effects were part of the job. Some plasterers repaired older buildings.

About 1 out of every 5 plasterers was self-employed.

Training, Other Qualifications, and Advancement

Most training authorities recommend completion of an apprenticeship as the best way to learn plastering. However, many people learn the trade by working as helpers or laborers, observing and being taught by experienced plasterers.

Apprenticeship programs, sponsored by local joint committees of contractors and unions, generally consist of 3 or 4 years of on-the-job training, in addition to at least 144 hours of annual classroom instruction in drafting, blueprint reading, and mathematics for layout work. Training is extensive. In class, apprentices start with a history of the trades and the industry. They also learn about the uses of plaster, costs, and many other concepts. On the job, they learn about lath bases, plaster mixes, methods of plastering, blueprint reading, and safety. Trainees follow the directions of and receive assistance from experienced plasterers.

Those who learn the trade informally as helpers gain only the basics—mixing and applying plasters. They usually start by carrying materials, setting up scaffolds, and mixing plaster. In a short time, they learn—through trial and error—to apply the scratch and brown coats. Learning to apply the finish coat takes considerably longer.

Applicants for apprentice or helper jobs generally must be at least 17 years old, in good physical condition, and have manual dexterity. Applicants who have a high school or vocational school education are preferred. Courses in general mathematics, mechanical drawing, and shop provide a useful background.

Plasterers may advance to supervisor, superintendent, or estimator for plastering contractors, or may become self-employed.

Employment Outlook

Little change is expected in the employment of plasterers through the mid-1980's. Nevertheless, a relatively small number of job openings will result from the need to replace experienced workers who retire, die, or transfer to other occupations.

The use of drywall materials in place of plaster has reduced the demand for plasterers in recent years. Nevertheless, plasterers still are needed for renovating older buildings that have plaster walls. Plaster is also used in some of the more expensive new buildings and on curved surfaces where drywall materials are not practical.

Earnings and Working Conditions

Union wage rates for plasterers in metropolitan areas averaged $9.48 an hour in 1976. This is about twice the average wage of nonsupervisory and production workers in private industry, except farming. Apprentice wage rates start at about half the rate paid to experienced plasterers and increase periodically. However, yearly earnings for plasterers and apprentices are generally lower than hourly rates would indicate because the annual number of hours that they work can be adversely affected by poor weather and fluctuations in construction activity.

Plastering requires considerable standing, stooping, and lifting. Plasterers work outdoors when applying stucco but most jobs are indoors.

A large proportion of plasterers are members of unions. They are represented by either the Operative Plasterers' and Cement Masons' International Association of the United States and Canada, or the Bricklayers, Masons and Plasterers' International Union of America.

Sources of Additional Information

For information about apprenticeships or other work opportunities, contact local plastering contractors; locals of the unions previously mentioned; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the State employment service.

For general information about the work of plasterers, contact:

Bricklayers, Masons and Plasterers' International Union of America, 815 15th St. NW., Washington, D.C. 20005.

International Association of Wall and Ceiling Contractors/Gypsum Drywall Contractors International, 1711 Connecticut Ave., NW., Washington, D.C. 20009.

Operative Plasterers' and Cement Masons' International Association of the United States and Canada, 1125 17th St. NW., Washington, D.C. 20036.

SHEET-METAL WORKERS

(D.O.T. 804.281 and .884)

Nature of the Work

Sheet-metal workers fabricate and install sheet-metal ducts for air-conditioning, heating, and ventilating systems; flat metal for kitchen walls and counters; and stamped metal for roofing and siding. Some workers specialize in either shopwork or on-site installation; others do both.

Sheet-metal workers fabricate much of the metal at the shop. Working from blueprint specifications, they measure, cut, bend, shape, and fasten most of the pieces that will be used on the job. Tapes are used for measuring; hand shears, hack saws, and power saws for cutting; and specially designed, heavy steel presses for cutting, bending, and shaping. Once the metal is measured and cut, workers then bolt, cement, rivet, solder, or weld the seams and joints together to form ducts, pipes, tubes, and other items.

At the construction site, sheet-metal workers usually just assemble and install pieces fabricated at the shop. Sometimes, however, workers make parts by hand at the worksite, using hammers, shears, and drills.

Workers install ducts, pipes, and tubes by joining them end to end and hanging them with metal braces secured to a ceiling or a wall. To hold the pieces together, workers sometimes bolt, glue, or solder the connections.

Molded and pressed sheet-metals, such as roofing and siding, usually are measured and cut on the job. After securing the first panel in place, workers interlock and fasten the grooved edge of the next panel into the grooved edge of the first. They nail the free edge of the panel to the structure. This two-step process is repeated for each additional panel. Finally, at joints, along corners, and around windows and doors, workers fasten machine-made molding for a neat, finished effect.

Places of Employment

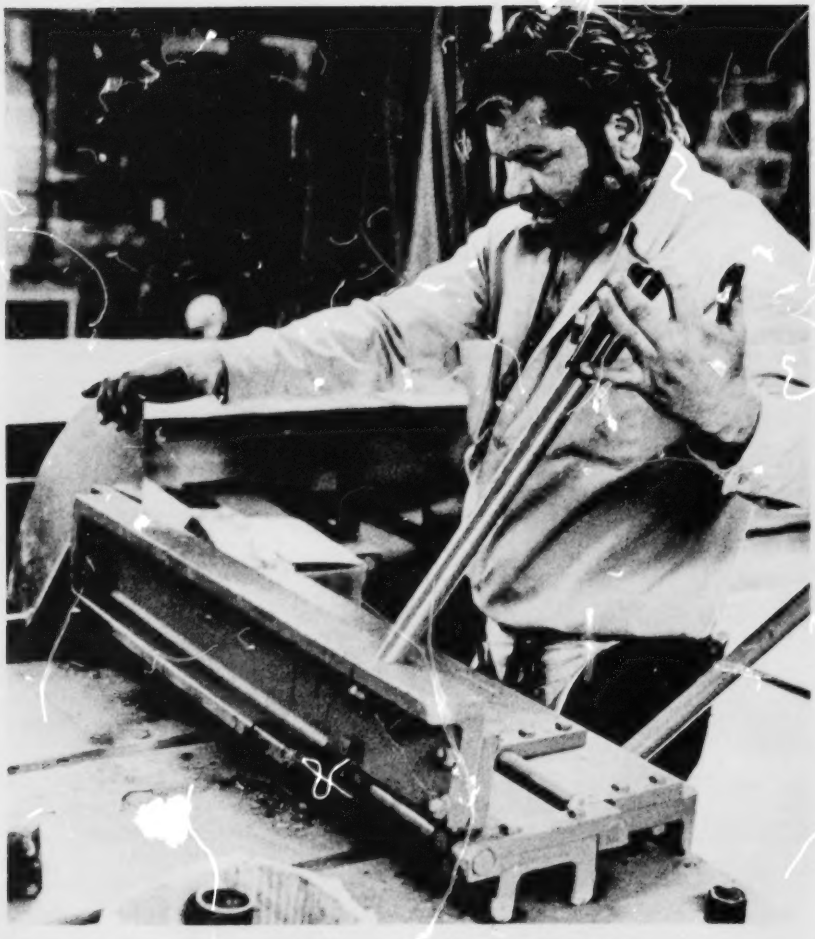
Sheet-metal workers in the construction industry—who numbered about 65,000 in 1976—are employed mainly by contractors who specialize in heating, refrigeration, and air-conditioning equipment, and by general contractors engaged in residential, industrial, and commercial building. Additional sheet-metal workers are employed by government agencies or businesses that do their own construction and alteration work. Very few are self-employed.

Sheet-metal workers are employed throughout the country, but jobs are concentrated in metropolitan areas.

Training, Other Qualifications, and Advancement

Many sheet-metal workers have acquired their skills by working as helpers, observing and being taught by experienced workers. The majority, however, have learned through apprenticeship, which provides the most thorough training.

The apprenticeship program usually consists of 4 years of on-the-job training, in addition to related classroom instruction. On the job, apprentices learn to use the tools, machines, equipment, and materials of the trade. In the first 2 years, they learn to measure, cut, bend, fabricate, and install sheet-metal. They begin with duct work and gradually advance to fabricating decorative pieces. Toward the end of their training, they learn to use materials such



Some sheet-metal workers specialize in shopwork.

as plastics and acoustical tile, which may be substituted for metal on some jobs. Classroom instruction covers subjects such as drafting, blueprint reading, mathematics, and first-aid. Safety is stressed throughout the program. In addition, apprentices learn the relationship between sheet-metal work and other construction work.

Workers who pick up the trade informally usually begin by carrying metal and cleaning up debris in a metal shop. While there, they learn about materials and their costs as well as tools and their uses. Then, as employers permit, helpers learn to set switches and operate levers on machines that bend or cut metal. In time, helpers leave the shop and go out on the job to learn installation.

Applicants for jobs as apprentices or helpers should be in good physical condition and have mechanical aptitude. Apprentices should have a high school or vocational school education or equivalent education. Courses in mathematics, mechanical drawing, and shop provide a helpful background for learning the trade.

Sheet-metal workers in construction may advance to supervisory jobs or may go into the contracting business.

Employment Outlook

Employment of sheet-metal workers in construction is expected to increase about as fast as the average for all occupations through the mid-1980's. In addition to jobs from employment growth, many openings will arise as experienced workers retire, die, or leave work for other reasons.

As population and business grow, more sheet-metal workers will be needed to install air-conditioning and heating duct work and other sheet-metal products in new houses, stores, offices, and other buildings. The demand for air-conditioning systems in older buildings also will boost employment growth.

Although employment is expected to increase over the long run, job openings may fluctuate from year to year due to ups and downs in construction activity. When construction activity is depressed, jobs for sheet-metal workers may be available in other industries.

Earnings and Working Conditions

Union sheet-metal workers in metropolitan areas had estimated average wages of $10.10 an hour in 1976. This is about twice the average for production and nonsupervisory workers in private industry, except farming. Sheet-metal apprentices generally start at 45 percent of the rate paid to experienced workers and receive periodic pay raises.

Many sheet-metal workers spend considerable time at the construction site, working either indoors or outdoors. Others work primarily in shops doing fabricating and layout work.

When installing gutters and skylights, they work high above ground. When installing ventilation and air-conditioning systems, they may work in awkward and cramped positions. Sheet-metal workers risk cuts and burns from materials and tools. The injury rate for workers in this trade is higher than the average for all construction workers.

A large proportion of sheet-metal workers are members of the Sheet Metal Workers' International Association.

Sources of Additional Information

For more information about apprenticeships or other work opportunities, contact local sheet-metal contractors or heating, refrigeration, or air-conditioning contractors; a local of the union mentioned above; a local joint union-management appren-

ticeship committee; or the nearest office of the State employment service or apprenticeship agency.

For general information about sheet-metal workers, contact:

Sheet Metal and Air Conditioning Contractors' National Association, Inc., 8224 Old Courthouse Rd., Tyson's Corner, Vienna, Va. 22180.

TILESETTERS

(D.O.T. 861.781)

Nature of the Work

In ancient Egypt and Rome, tile was used for the design and construction of mosaics—an art form using small, decorative ceramic squares. Today, in a fashion similar to that of the ancient artists, tilesetters apply tile to floors, walls, and ceilings.

To set tile, which ranges in size from 1/2 inch to 6 inches square, workers in this trade use either cement or mastic (a very sticky paste). When using cement, tilesetters first must tack a support of screenlike mesh to the floor, wall, or ceiling. They mix a coarse cement, spread it onto the screen with a trowel, and, with a rakelike device, scratch the surface of the wet cement. After the cement has dried workers trowel on a richer coat of cement, working it back and forth in sweeping motions until it is smooth and even.

When using mastic to set tile, tilesetters need a flat, solid surface such as drywall or concrete. Workers spread the mastic with a tooth-edged metal trowel to create tiny ridges in the mastic. When the tile is set onto the ridges, it creates a suction that helps hold the tile.

Since tile is of various colors, shapes, and sizes, workers sometimes prearrange the tiles on a dry floor according to a specified design. This allows workers to examine the pattern and make any necessary changes.

Whether or not the tiles are prearranged, tilesetters place each tile onto the cement or mastic. Some tiles are cut with either a machine saw or a special cutting tool so they can fit into corners and around pipes, tubs, and wash basins. Once the tile is placed, tilesetters gently tap the surface of the tiles with a small block of wood so that all the tiles rest evenly and flatly.

When the cement or the mastic has "set" behind the tile, tilesetters use a rubber trowel to cover the tile and the joints with grout—a very fine cement mixture. They then scrape the surface with a rubber-edged device called a squeegee. This action safely removes grout from the face of the tiles, forces it into the joints, and removes any excess. Before the grout dries, workers wash the surface with water.

Places of Employment

Tilesetters—who numbered about 36,000 in 1976—are employed mainly in nonresidential construction projects, such as schools, hospitals, and public and commercial buildings. A significant proportion of tilesetters—about one out of five—are self-employed.

Tilesetters are employed throughout the country but are found largely in the more populated urban areas.

Training, Other Qualifications, and Advancement

Most training authorities recommend the completion of a 3-year ap-

About 1 out of 5 tilesetters is self-employed.

prenticeship program as the best way to learn tilesetting. A substantial proportion of tilesetters, however, acquire their skills informally by working as helpers and being taught by experienced workers.

The apprenticeship program generally consists of on-the-job training and related classroom instruction in subjects such as blueprint reading, layout work, and basic mathematics.

Apprentices begin by learning the names of tools and how to use them. Within a short time they are taught to mix and apply cement, then to apply mastic. Later, they learn to cut tile and install it.

Those who learn informally generally receive less thorough training. They start by carrying supplies, cleaning work areas, and washing off the finished tile. Depending on the employer, a helper may learn to spread cement or mastic. Eventually, a helper is taught to cut and set tile.

When hiring apprentices or helpers, employers usually prefer high school or vocational school graduates who have had courses in general mathematics, mechanical drawing, and shop. Good physical condition, manual dexterity, and a good sense of color harmony also are important assets.

Skilled tilesetters may become supervisors or start their own contracting businesses.

Employment Outlook

Employment of tilesetters is expected to increase about as fast as the average for all occupations through the mid-1980's. While employment growth will provide some new job opportunities, most will result from the need to replace tilesetters who retire, die, or leave the occupation for other reasons. Because tilesetters is a small occupation, however, there will be relatively few job openings annually.

Population and business growth is expected to cause an increase in the construction of houses and other buildings, thus increasing the demand for tilesetters. The trend toward two tile bathrooms or more in houses and apartments also will spur employment in this trade.

Earnings and Working Conditions

According to 1976 estimates of union wages in metropolitan areas, hourly rates for tilesetters averaged $9.35, or about twice the hourly rate paid to nonsupervisory and production workers in private industry, except farming. Hourly wage rates for apprentices start at about 50 to 60 percent of the rate paid to union workers and increase periodically.

Since tilesetters work mostly indoors, the annual number of hours they work generally is higher than some of the other contruction crafts. This difference may be reflected in added annual earnings.

The principal unions organizing these workers are the International Union of Bricklayers and Allied Craftsmen; and the International Association of Marble, Slate and Stone Polishers, Rubbers and Sawyers, Tile and Marble Setters' Helpers and Marble Mosaic and Terrazzo Workers' Helpers.

Sources of Additional Information

For details about apprenticeship or other work opportunities in this trade, contact local tile setting contractors; locals of the unions previously mentioned; or the nearest office of the State employment service or State apprenticeship agency.

For general information about the work of tilesetters, contact:

International Union of Bricklayers and Allied Craftsmen, International Masonry Apprenticeship Trust, 815 15th St. NW., Washington, D.C. 20005.

Tile Contractors' Association of America, Inc., 112 North Alfred St., Alexandria, Va. 22314.

What to Look For in this Reprint

To make the *Occupational Outlook Handbook* easier to use, each occupation or industry follows the same outline. Separate sections describe basic elements, such as work on the job, education and training needed, and salaries or wages. Some sections will be more useful if you know how to interpret the information as explained below.

The TRAINING, OTHER QUALIFICATIONS, AND ADVANCEMENT section indicates the preferred way to enter each occupation and alternative ways to obtain training. Read this section carefully because early planning makes many fields easier to enter. Also, the level at which you enter and the speed with which you advance often depend on your training. If you are a student, you may want to consider taking those courses thought useful for the occupations which interest you.

Besides training, you may need a State license or certificate. The training section indicates which occupations generally require these. Check requirements in the State where you plan to work because State regulations vary.

Whether an occupation suits your personality is another important area to explore. For some, you may have to make responsible decisions in a highly competitive atmosphere. For others, you may do only routine tasks under close supervision. To work successfully in a particular job, you may have to do one or more of the following:

- motivate others
- direct and supervise others
- work with all types of people
- work with things—you need good coordination and manual dexterity
- work independently—you need initiative and self-discipline
- work as part of a team
- work with details, perhaps numbers or laboratory reports
- help people
- use creative talents and ideas
- work in a confined area
- do physically hard or dangerous work
- work outside in all types of weather

A counselor can help you find out more about your interests and abilities so you can judge whether a job's characteristics suit you.

The EMPLOYMENT OUTLOOK section tells whether or not the job market is likely to be favorable. Usually an occupation's expected growth is compared to the average projected growth rate for all occupations (20.1 percent between 1976 and 1985). The following phrases are used:

Much faster	50% or more
Faster	25.0 to 49.9%
About as fast	15.0 to 24.9%
Slower	4.0 to 14.9%
Little change	3.9 to -3.9%
Decline	-4.0% or more

Generally, job opportunities are favorable if employment is growing at least as fast as for the economy as a whole.

But, you would have to know the number of people competing with you to be sure of your prospects. Unfortunately, this supply information is lacking for most occupations.

There are exceptions, however, especially among professional occupations. Nearly everyone who earns a medical degree, for example, becomes a practicing physician. When the number of people pursuing relevant types of education and training and then entering the field can be compared with the demand, the outlook section indicates the supply/demand relationship as follows:

Excellent	Demand much greater than supply
Very good	Demand greater than supply
Good or favorable	Rough balance between demand and supply
May face competition	Likelihood of more supply than demand
Keen competition	Supply greater than demand

Competition or few job openings should not stop your pursuing a career that matches your aptitudes and interests. Even small or overcrowded occupations provide some jobs. So do those in which employment is growing very slowly or declining.

Growth in an occupation is not the only source of job openings because the number of openings from turnover can be substantial in large occupations. In fact, replacement needs are expected to create 70 percent of all openings between 1976 and 1985.

Finally, job prospects in your area may differ from those in the Nation as a whole. Your State employment service can furnish local information.

The EARNINGS section tells what workers were earning in 1976.

Which jobs pay the most is a hard question to answer because good information is available for only one type of earnings—wages and salaries—and not even this for all occupations. Although 9 out of 10 workers receive this form of income, many earn extra money by working overtime, night shifts, or irregular schedules. In some occupations, workers also receive tips or commissions based on sales or service. Some factory workers are paid a piece rate—an extra payment for each item they make.

The remaining 10 percent of all workers—the self-employed—includes people in many occupations—physicians, barbers, writers, and farmers, for example. Earnings for self-employed workers even in the same occupation differ widely because much depends on whether one is just starting out or has an established business.

Most wage and salary workers receive fringe benefits, such as paid vacations, holidays, and sick leave.

Workers also receive income in goods and services (payment in kind). Sales workers in department stores, for example, often receive discounts on merchandise.

Despite difficulties in determining exactly what people earn on the job, the Earnings section does compare occupational earnings by indicating whether a certain job pays more or less than the average for all nonsupervisors in private industry, excluding farming.

Each occupation has many pay levels. Beginners almost always earn less than workers who have been on the job for some time. Earnings also vary by geographic location but cities that offer the highest earnings often are those where living costs are most expensive.

What's an ad for the OOQ doing in a place like this?

The career information contained in the reprint you are reading was taken from the 1978–79 edition of the Occupational Outlook Handbook. But the Handbook is not the only source of useful career information published by the Bureau of Labor Statistics. The Handbook's companion, the Occupational Outlook Quarterly, is published four times during the school year to keep subscribers up to date on new occupational studies completed between editions of the Handbook. The Quarterly also gives practical information on training and educational opportunities, salary trends, and new and emerging jobs—just what people need to know to plan careers.

If you were a subscriber to recent issues of the Occupational Outlook Quarterly, you could have learned

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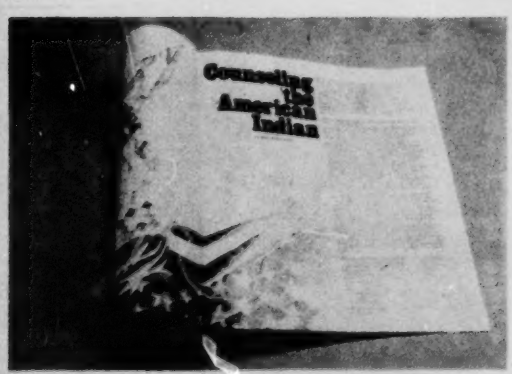

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